

WHAT IS CLAIMED IS:

1. A semiconductor card comprising:

a printed circuit substrate having a circuit side, a back side and a peripheral substrate edge with front and back edge corners, the substrate including a plurality of conductors on the circuit side and a plurality of external contacts on the back side in electrical communication with the conductors;

at least one semiconductor component on the circuit side in electrical communication with the conductors;

a plastic body molded to the circuit side and extending laterally from the peripheral edge to form a card having a front face and a back face with a smooth card edge connecting said faces, said plastic body encapsulating the semiconductor component and conductors while leaving external contacts exposed; and

a plurality of narrow ends of connecting segments of the substrate intersecting with a peripheral edge and exposed therein.
2. A semiconductor card in accordance with claim 1, wherein the back side of said substrate is substantially exposed.
3. A semiconductor card in accordance with claim 1, further comprising a cut central portion of said card edge intermediate and separated from the peripheral edges along the front face and back face.
4. A semiconductor card in accordance with claim 1, wherein said back face is substantially continuously planar.
5. A semiconductor card in accordance with claim 1, wherein said substrate comprises a printed circuit board.

PATENT
ATTORNEY DOCKET 4717US

6. A semiconductor card in accordance with claim 1, wherein said card has a thickness of about 1 mm to about 6 mm.
7. A semiconductor card in accordance with claim 1, wherein said substrate has a thickness of about 0.2 to about 1.6 mm.
8. A semiconductor card in accordance with claim 1, wherein said substrate comprises a reinforced organic polymer resin.
9. A semiconductor card in accordance with claim 1, wherein the plastic body comprises a Novoloc epoxy resin.
10. A semiconductor card in accordance with claim 1, wherein said at least one semiconductor component comprises flash memory.
11. A semiconductor card in accordance with claim 1, wherein said card comprises a memory card for digitally recording and retrievably storing photographic data in a digital camera.
12. A module for forming a semiconductor card with a card outline, said module comprising:
a strip of planar insulating material having a circuit side and a back side;
a peripheral opening defining the outer edge of a substrate and the inner edge of a frame, said opening having an inner edge inside of the card outline and an outside edge outside of the card outline; and
a plurality of connecting segments of said strip connecting said substrate to said frame, said connecting segments configured for forced movement to a level different

PATENT
ATTORNEY DOCKET 4717US

from the frame, wherein said substrate, frame, opening and segments comprise said module.

13. A module in accordance with claim 12, wherein the width of said peripheral opening adjacent connecting segments is enlarged to elongate said segments.
14. A module in accordance with claim 12, wherein said connecting segments connect the substrate to the frame on opposing sides thereof.
15. A module in accordance with claim 12, wherein said strip of planar material comprises a printed circuit board.
16. A module in accordance with claim 12, wherein said substrate has a thickness of about 0.2 to about 1.6 mm.
17. A module in accordance with claim 12, wherein said substrate comprises a reinforced organic polymer resin.
18. A transfer mold assembly for forming a semiconductor card with peripheral card edges from a planar module having a peripheral opening defining a substrate therein, said opening interrupted by a plurality of narrow module segments, said assembly comprising:
a first plate having a first molding surface for contacting the back side of a planar module;
a second plate having a second molding surface for contacting the circuit side of the planar module;

an internal molding cavity comprising portions of the first and second molding surfaces;

Apparatus for injecting fluid molding compound into the internal molding cavity; peripheral molding structures defining lateral edges of a semiconductor card body, said molding structures having a plurality of slits for downward passage of said module segments;

a plurality of internal molding cavity portions comprising wing cavities projecting outwardly from the peripheral molding structures; and

a plurality of throughholes in the second plate, said throughholes aligned with the module segments outside of the peripheral molding structures.

19. A transfer mold assembly in accordance with claim 18, further comprising:
a plurality of down-set pins insertable in said throughholes to motivate module segments and substrate attached thereto downwardly from the frame to a lower position against a cavity surface, said throughholes positioned to pass through said wing cavities outside of said peripheral molding structures.
20. A method for fabricating a semiconductor card, comprising:
providing a strip comprising a module with a peripheral opening defining an internal substrate and an external frame, and a plurality of connecting segments connecting the substrate to the frame, the substrate comprising a circuit side having a circuit thereon and a back side having external contacts thereon;
mounting at least one semiconductor component to the circuit side in electrical communication with the external contacts;
installing the strip in a molding assembly having a molding cavity with internal surfaces in first and second mold plates and wherein the substrate is forcibly moved to a level differing from the level of the frame;

PATENT
ATTORNEY DOCKET 4717US

molding a plastic body on the circuit side of the substrate, said body including edge portions of the card formed laterally outwardly from the substrate, and a plurality of wings extending laterally outwardly from said edge portions; and removing the molded casting from the molding assembly and singulating the card from the wings by excision.

21. A method in accordance with claim 20, wherein the substrate is moved to a level at which the back side thereof abuts a surface of the molding cavity.
22. A method in accordance with claim 20, wherein said substrate is moved a distance of about 0.2 - 3 times the substrate thickness.
23. A method in accordance with claim 20, wherein said substrate is moved by movement of pins passing through down-set throughholes in said molding assembly and wings to contact, move and clamp the connecting segments attached to the substrate.
24. A method in accordance with claim 20, wherein portions of said peripheral opening adjacent the outer ends of said connecting segments are elongated laterally outward to lengthen said connecting segments.
25. A method in accordance with claim 20, wherein said frame is connected by connecting segments to the substrate on opposing edges thereof.
26. A method in accordance with claim 20, wherein said molding step encapsulates the circuit side of the substrate and leaves the external contacts uncovered.

27. A method in accordance with claim 23, wherein the molded casting is removed from the molding assembly by inserting pins into the down-set throughholes to eject the molding thereby.

28. A method in accordance with claim 23, wherein the molded casting is removed from the molding assembly by further insertion of the down-set pins through the down-set throughholes to eject the molding thereby.

29. A system for forming a semiconductor card having a card periphery, comprising:
a planar module having a substrate formed therein by a peripheral opening surrounded by a frame;
a plurality of segments of the module connecting said substrate to said frame;
a transfer mold assembly comprising:
a first plate having a first molding surface for contacting the back side of a planar module, said first plate having a peripheral raised portion with a plurality of slits for passage of module segments therethrough;
a second plate having a second molding surface for contacting the circuit side of the planar module;
an internal molding cavity comprising portions of the first and second molding surfaces;
means for injecting fluid molding compound into the internal molding cavity;
peripheral molding structures defining lateral edges of a semiconductor card body;
a plurality of internal molding cavity portions comprising wing cavities projecting outwardly from the peripheral molding structures;
a plurality of throughholes in the second plate, said throughholes aligned with the module segments outside of the peripheral molding structures; and
a plurality of down-set pins insertable in said throughholes to motivate module

PATENT
ATTORNEY DOCKET 4717US

segments and substrate attached thereto downwardly from the frame to a lower position against a cavity surface, said throughholes passing through said wing cavities outside of said peripheral molding structures.

30. A system in accordance with claim 29, wherein said module comprises one of a set of modules on a strip insertable into a molding assembly for simultaneous molding.
31. A system in accordance with claim 29, wherein said molding assembly comprises a transfer mold.
32. A system in accordance with claim 29, wherein said plurality of connecting module segments comprises four segments.
33. A system in accordance with claim 29, wherein the peripheral opening has a width which is increase adjacent the outer ends of said module segments.
34. A system in accordance with claim 29, further comprising ejection pins insertable into said throughholes to eject said casting from said molding assembly.